

What is claimed is:

1. A substrate processing apparatus for polishing a substrate, comprising:

5        an edge-portion polisher for pressing a polishing tape against an edge portion of a substrate and making a relative movement between the polishing tape and the substrate to polish the edge portion of the substrate; and

10        a bevel-portion polisher for pressing a polishing tape against a bevel portion of the substrate and making a relative movement between the polishing tape and the substrate to polish the bevel portion of the substrate.

15        2. A substrate processing apparatus according to claim 1, wherein said edge-portion polisher and said bevel-portion polisher are provided in a polishing unit.

20        3. A substrate processing apparatus according to claim 2, wherein said polishing unit has a notch polisher for pressing a polishing tape against a notch in the substrate and making a relative movement between the polishing tape and the substrate to polish the notch of the substrate.

25        4. A substrate processing apparatus according to claim 2, wherein said polishing unit has a cleaning device for conducting a primary cleaning of a polished substrate.

5. A substrate processing apparatus according to claim 1, wherein said edge-portion polisher is structured to polish the edge-portion of the substrate by clamping upper and lower surfaces of the edge portion of the substrate through the polishing tape by a pair of clamp members while the substrate is held and rotated by a substrate holding table.

6. A substrate processing apparatus according to claim 5, wherein said clamp members are movable in a radial direction of the substrate for adjusting a radial position of the edge portion to be polished by said edge-portion polisher.

7. A substrate processing apparatus according to claim 5, wherein said edge-portion polisher further comprises a roller guide for guiding the polishing tape radially outwardly of the substrate to be polished between said clamp members, and for guiding the polishing tape from one of said clamp members toward the other of said clamp members.

8. A substrate processing apparatus according to claim 5, wherein said edge-portion polisher further comprises a mechanism for opening and closing said clamp members, said clamp members and said mechanism being vertically movable.

9. A substrate processing apparatus according to claim 1, wherein said bevel-portion polisher is structured to

polish the bevel-portion of the substrate by pressing the polishing tape against the bevel-portion of the substrate with a polishing head having a resilient member while the substrate is held and rotated by a substrate holding table.

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10. A substrate processing apparatus according to claim 9, wherein said polishing head is movable in a radial direction of the substrate.

10        11. A substrate processing apparatus according to claim 3, wherein said notch polisher is structured to polish the notch of the substrate by pressing the polishing tape against the notch in the substrate with a resilient member and moving the polishing tape while the substrate is held by  
15 a substrate holding table.

12. A substrate processing apparatus according to claim 11, wherein said resilient member is vertically movable so that the polishing tape is pressed against an upper edge, a  
20 radially outward edge, and a lower edge of the notch, selectively.

13. A substrate processing apparatus according to claim 2, further comprising:

25        a cleaning unit for cleaning and drying the substrate after the substrate has been polished by said polishing unit and removed from said polishing unit.

14. A substrate processing apparatus according to claim 1, further comprising:

an image sensor for imaging a region, being polished, of the substrate while the substrate is being polished; and

5 a controller for processing an image obtained by said image sensor to determine a polishing state of the region being polished.

15 15. A substrate processing apparatus according to claim 14, wherein said controller detects a polishing end point from the polishing state of the region being polished.

16. A substrate processing apparatus according to claim 1, further comprising:

15 a photosensor for applying light to a region, being polished, of the substrate and detecting light reflected by the region being polished while the substrate is being polished; and

20 a controller for analyzing scattered light detected by said photosensor to determine a polishing state of the region being polished.

25 17. A substrate processing apparatus according to claim 16, wherein said controller detects a polishing end point from the polishing state of the region being polished.

18. A substrate processing apparatus according to claim 1, further comprising:

a controller for detecting a torque value to rotate the substrate on a basis of a signal from a motor for rotating the substrate while the substrate is being polished, and analyzing a change in the torque value.

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19. A substrate processing apparatus according to claim 18, wherein said controller detects a polishing end point from the change in the torque value.

10        20. A substrate processing apparatus according to claim 1, further comprising:

          a controller for detecting a torque value of a rotational shaft of a substrate holding table for holding and rotating the substrate while the substrate is being  
15 polished, and analyzing a change in the torque value.

21. A substrate processing apparatus according to claim 20, wherein said controller detects a polishing end point from the change in the torque value.

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22. A substrate processing apparatus according to claim 1, further comprising:

          a controller for measuring a tension applied to the polishing tape which is held in sliding contact with the  
25 region, being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.

23. A substrate processing apparatus according to claim 22, further comprising:

5 a controller for measuring a tension applied to a portion for pressing the polishing tape against the region, being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.

24. A substrate processing apparatus for polishing a 10 substrate, comprising:

a pair of clamp members for clamping face and reverse sides of an edge portion of a substrate through a polishing tape; and

15 a mechanism for opening and closing said clamp members; wherein said clamp members are closed by said mechanism to press the polishing tape against the face and reverse sides of the edge portion of the substrate.

25. A substrate processing apparatus according to claim 20 24, further comprising:

a substrate holding table for holding and rotating the substrate at a predetermined speed.

26. A substrate processing apparatus according to claim 25 24, further comprising:

a displacing mechanism for displacing said clamp members and said mechanism in a radial direction of the substrate.

27. A substrate processing apparatus according to claim 24, further comprising:

5 a roller guide disposed between said clamp members for guiding the polishing tape from one of said clamp members toward the other of said clamp members.

28. A substrate processing apparatus according to claim 24, wherein said clamp members and said mechanism are  
10 supported in a floating manner on a fixed member so that said clamp members and said mechanism are movable in a direction substantially perpendicular to a surface of the substrate.

15 29. A substrate processing apparatus according to claim 24, further comprising:

an image sensor for imaging a region, being polished, of the substrate while the substrate is being polished; and

20 a controller for processing an image obtained by said image sensor to determine a polishing state of the region being polished.

30. A substrate processing apparatus according to claim 29, wherein said controller detects a polishing end point  
25 from the polishing state of the region being polished.

31. A substrate processing apparatus according to claim 24, further comprising:

a photosensor for applying light to a region, being polished, of the substrate and detecting light reflected by the region being polished while the substrate is being polished; and

5        a controller for analyzing scattered light detected by said photosensor to determine a polishing state of the region being polished.

32. A substrate processing apparatus according to claim  
10 31, wherein said controller detects a polishing end point from the polishing state of the region being polished.

33. A substrate processing apparatus according to claim 24, further comprising:

15        a controller for detecting a torque value to rotate the substrate on a basis of a signal from a motor for rotating the substrate while the substrate is being polished, and analyzing a change in the torque value.

20        34. A substrate processing apparatus according to claim 33, wherein said controller detects a polishing end point from the change in the torque value.

35. A substrate processing apparatus according to claim  
25 24, further comprising:

a controller for detecting a torque value of a rotational shaft of a substrate holding table for holding

and rotating the substrate while the substrate is being polished, and analyzing a change in the torque value.

36. A substrate processing apparatus according to claim  
5 35, wherein said controller detects a polishing end point from the change in the torque value.

37. A substrate processing apparatus according to claim  
24, further comprising:

10 a controller for measuring a tension applied to the polishing tape which is held in sliding contact with the region, being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.

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38. A substrate processing apparatus according to claim  
37, further comprising:

a controller for measuring a tension applied to a  
portion for pressing the polishing tape against the region,  
20 being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.

39. A substrate processing apparatus for polishing a  
25 substrate, comprising:

a substrate holding table for holding a substrate;  
a resilient member for pressing a polishing tape  
against a notch in the substrate; and

a pressing mechanism for pressing said resilient member under a predetermined pressing force to press the polishing tape against the notch in the substrate.

5           40. A substrate processing apparatus according to claim 39, further comprising:

          a support arm for supporting said resilient member thereon; and

          a swinging mechanism for swinging said support arm  
10       vertically;

          wherein said swinging mechanism swings said support arm vertically so that the polishing tape is pressed against an upper edge, a radially outward edge, and a lower edge of the notch, selectively.

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          41. A substrate processing apparatus according to claim 39, wherein said pressing mechanism comprises an air cylinder.

20           42. A substrate processing apparatus according to claim 39, further comprising:

          an image sensor for imaging a region, being polished, of the substrate while the substrate is being polished; and

          a controller for processing an image obtained by said  
25       image sensor to determine a polishing state of the region being polished.

43. A substrate processing apparatus according to claim 42, wherein said controller detects a polishing end point from the polishing state of the region being polished.

5        44. A substrate processing apparatus according to claim 39, further comprising:

        a photosensor for applying light to a region, being polished, of the substrate and detecting light reflected by the region being polished while the substrate is being  
10 polished; and

        a controller for analyzing scattered light detected by said photosensor to determine a polishing state of the region being polished.

15        45. A substrate processing apparatus according to claim 44, wherein said controller detects a polishing end point from the polishing state of the region being polished.

        46. A substrate processing apparatus according to claim  
20 39, further comprising:

        a controller for detecting a torque value to rotate the substrate on a basis of a signal from a motor for rotating the substrate while the substrate is being polished, and analyzing a change in the torque value.

25        47. A substrate processing apparatus according to claim 46, wherein said controller detects a polishing end point from the change in the torque value.

48. A substrate processing apparatus according to claim 39, further comprising:

5 a controller for detecting a torque value of a rotational shaft of a substrate holding table for holding and rotating the substrate while the substrate is being polished, and analyzing a change in the torque value.

49. A substrate processing apparatus according to claim 10 48, wherein said controller detects a polishing end point from the change in the torque value.

50. A substrate processing apparatus according to claim 39, further comprising:

15 a controller for measuring a tension applied to the polishing tape which is held in sliding contact with the region, being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.

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51. A substrate processing apparatus according to claim 50, further comprising:

a controller for measuring a tension applied to a portion for pressing the polishing tape against the region, 25 being polished, of the substrate while the substrate is being polished, to determine a polishing state of the region being polished.